Thesis/
Reports
Theisen,
P. A.

INSECT PESTS OF COMMERCIAL TREE SEED CROPS IN THE PACIFIC NORTHWEST

Peter A. Theisen

USDA Forest Service
Region 6
Tree Seed Paper 5
Revised 10/17/85

Insect Pests of Commercial Tree Seed Crops in the Pacific Northwest

by

Peter A. Theisen

Regional Geneticist

LIBRARY COPY
ROCKY MTN. FOREST & RANGE
EXPERIMENT STATION

Damage by flower, cone, and seed insects can seriously affect seed yield from cones of northwest conifers and affect seed quality. The types of damage of immediate concern to those harvesting seed to meet tree seed inventory plan needs are those that affect seed yield and quality.

Damage to the cone may result in failure of cones to open during processing or the retention of seed in the open cones. Mold is associated with insect damage cones during storage with resulting fungal damage to the seed. The mold from insect damaged cones can spread to undamaged cones, thus infecting an entire cone lot.

Cone and seed insects may completely destroy seeds, or damage them so that they will not germinate, or so weaken them that they will not retain viability in storage or are highly susceptible to fungal damage during germination. An especially insidious type of damage is caused by the seed bug.

Following is a brief description of the types of insects which damage commercial tree seed crops in the Pacific Northwest and severity of damage.

1. Aphids (Homoptera) - Small wingless insects with sac like bodies which may or may not be covered by waxy secretions. They suck liquids from plant tissue. Winged adults may occur. Damage to seed crops is slight.

2. Beetles (Coleoptera)

A. Cone beetle - Grubs feeding through cone axis and scales or beetles in dead cones.

(1) Conophthous spp. - Cones killed by adults which bore small tunnel into base of cone stem and then through the axis of the cone. Eggs are deposited singly in niches on each side of the tunnel. One successful attack will kill a cone. A major problem in sugar pine. May be locally important in other pines.

B. Cone borer - Adult beetle lays eggs in dead or mature cones. Larvae feeds on scales and seed. May destroy seed in stored cones. Not identified as a significant problem in Region 6.

C. Cone weevil - Biology not well known.

D. Seed beetle - Adult ground beetle feeds on dispersed seed. Does not damage seed or cones in trees.

E. Twig borer - Grubs feeding in cone bearing twigs causing premature death on cones. Damage to seed crops is generally slight.

3. Bugs (Hemiptera)

A. Seed bug - Adults and nymphs suck juices from seed. Sighting of bug is indication of seed damage which may be as high as 60 percent. No external evidence of damage. Damage difficult to assess without use of x-ray.

4. Chalcids (Hymenoptera)

A. Seed chalcid - Adult lays eggs in seeds in young cones. A single footless grub with indistinct head develops per seed and usually over winters in seed. No external evidence of damage.

5. Lice - Not of any consequence. Feed or catkins of alder and willow. Adults resemble cicadas but are about the size of aphids. Nymphs suck liquids from plant tissue.

6. Maggots (Diptera) - Adult fly lays eggs between scales of young cone. In true fir maggots may destroy 1 to 2 percent of seed crop when present, may destroy up to 25 percent of seed in single cone, may kill cones before seed is mature. Usually no external evidence of damage.

A. Cone maggot - Footless maggots boring through scales and seeds.

B. Seed maggot - Footless maggots feeding on young seeds.

7. Midges (Diptera) - Small reddish pink to yellow or orange larvae.

A. Cone midge - Adult fly deposits eggs between scales of young cones. Larvae feed beneath cone scales, damaging both scales and seed. Damage may be severe in western redcedar.

B. Cone axis midge - Adult fly lays eggs near ovules when flowers are open for pollination. Larvae feed in scale during early summer, gradually move into cone axis. Usually no external evidence of damage.

C. Cone gall midge - Adult fly deposits eggs near base of cone scales in newly opened flower. Larvae forms a gall or swelling in the cone scale, usually adjacent to a seed. Galling prevents seed release from cone. A major problem in Douglas-fir. Damage to seed crop may be severe. No external evidence of damage except severe infestation can result in premature death of cone scales.

D. Cone scale midge - Adult fly deposits eggs between scales of young cones. Larvae feed on the the inter surface of cone scale, often between the seed wing and the scale. No direct damage to seed. No external evidence of damage except severe infestations can result in premature death of cone scales.

E. Seed midge - Adult deposits eggs in the openings of the ovules. Each larvae feeds in and destroys a single seed. No external evidence of damage. Usually not a major pest.

F. Resin midge - Feeds on resin between cone scales usually in association with other insects. Little or no impact on seed crop.

8. Moths (Lepidoptera)

A. Budworms - Adult moth lays eggs on needles of conifers, drawing them together with a silken web. Young caterpillars feed on opening buds and new needles drawing them together with a silken web. Later they may leave their protective web and feed openly on needles and cones. Larvae may cause severe damage by feeding on cone scales and seeds. Usually only a problem under outbreak conditions.

B. Cone borer - Adult moth lays eggs singly between cone scales or at base of cone. Caterpillars work through cones and seed. Presence of borer in cone indicates unusable cone. No external evidence of damage.

C. Cone looper - Caterpillar feeding on outside of cone. Usually not a serious pest.

D. Cone miner - Caterpillar feeding indiscriminately through cones damaging cones and seed. Damage to seed crops is slight.

E. Cone moth - Adult moth lays eggs on outer surface of cone bracts or on scales of cones. There may be no external evidence of damage or surface frass may be present. Larvae usually complete feeding in mid to late summer. Damage may range from light to extreme.

F. Cone worm (Dioryctria spp.) - Adult moth lay eggs on cone. Larvae bore food channels indiscriminately through scales and seed causing extensive damage. Feeding may continue in stored cones. External evidence of damage present in the form of frass. Infested cones of Douglas-fir and spruce are usually completely destroyed. Damage in ponderosa pine is less severe, taking 4 to 6 larvae to destroy a cone.

G. Pitch nodule moth - Caterpillar protected by pitch nodule and feeding on cone or branch just below cones, killing branch tip. Damage impact is slight.

H. Seed moth and seed worm - Adult moth lays eggs between cone scales of open flower. Larvae enter seed to feed on contents leaving frass in seed. No external evidence of damage. Damage to seed crop can be severe. A single larvae may destroy a number of seed.

I. Shoot moth and twig moth - Caterpillar feeding in shoot or twig causing death of cones. Damage to seed crops is minor.

J. Trip moth - Larvae feed in cones throughout the summer. A major pest in incense cedar and Port-Orford cedar.

9. Sawflies (Hymenoptera) - Larvae with seven pairs of prolegs feeding in or on flowers and cones. Usually only a problem under outbreak conditions.

10. Scales (Homoptera) - Wingless insects with sac like bodies covered by waxy secretions. They suck liquids from plant tissue. Damage to seed crops is slight.

11. Thrips (Thysanoptera) - Minute insects with elongated fusiform bodies and narrow fringed wings which feed on flowers. Damage to seed crops is considered to be slight based on current information.

Table 1 is a checklist by tree species of flower, cone, and seed insects in the following format:

A. Tree species

B. Affected part of reproductive structure.

C. Common insect category name.

D. Scientific name of insect, common name of insect and importance of damage.

The codes for the importance of damage are:

1 = Major
2 = Moderate
3 = Minor
4 = Slight
5 = Usually secondary

Tables 2 and 3 show the types of insects by tree species which may cause damage to commercial seed crops of Pacific Northwest trees.

References

Barcia, D. R. and E. P. Merkel.
1972. Bibliography on insects destructive to flowers, cones, and seeds of North American conifers. USDA Forest Service Research Paper SE-92, 80 p.

Furniss, R. L. and V. M. Carolin.
1977. Western forest insects. USDA Forest Service Miscellaneous Publications No. 1339, 654 p.

Hedlin, A. F.
1974. Cone and seed insects of British Columbia. Canadian Forestry Service, BC-X-90. 63 p.

Hedlin, A. F. et. al.
1980. Cone and seed insects of North American conifers. Canadian Forestry Service, United States Forest Service, Unnumbered Publication, 122 p.

Keen, F. P.
1958. Cone and seed insects of western forest trees. USDA Technical Bulletin No. 1169. 168 p.

Krugman, S. L. and T. W. Koerber.
1969. Effect of cone feeding by Leoptoglossus occidentalis on ponderosa pine seed development. Forest Science 15:104-111.

Ruth, D. S.
1980. A guide to insect pests in Douglas-fir seed orchards. Canadian Forestry Service/Pacific Forest Research Centre, Victoria, B. C. BC-X-204, 19 p.

Table 1. Flower, Seed, and Cone Insect Checklist

Alaska Yellow Cedar		
None reported		
Alder		
Flowers		
Louse, Jumping plant		
Psylla alni	a psyllid	3
Sawfly		
Xyela spp.	a sawfly	3
Brewer Spruce		
Seed and cone		
Maggot		
Hylemya anthracina	spruce cone maggot	1
Douglas-fir		
Flowers		
Thrip		
Franklinella occidentalis	western flower thrip	3
Cones and seeds		
Aphid		
Adelges cooleyi	cooley spruce gall aphid	4
Beetles		
Ernobius punctulatus	cone borer	5
Pityophthorus oravius	a twig beetle	3
Pterostichus algidus	a seed beetle	4
Lepesoma lecontei	a cone weevil	4
Bug		
Leptoglossus occidentalis	western seed bug	1
Chalcid		
Megastigmus spermotrophus	Douglas-fir seed chalcid	1
Maggots		
Earomyia barbara	a cone maggot	4
Earomyia aquilonia	a cone maggot	4
Midges		
Camptomyia pseudotsuga	a cone scale midge	3
Contarinia oregonensis	Douglas-fir cone gall midge	1
Contarinia washingtonensis	Douglas-fir cone scale midge	3
Moths		
Argyresthia pseudotsuga	a twig moth	3
Barbara colfaxiana	Douglas-fir cone moth	1
Chionodes periculella	a cone miner	4
Choristoneura occidentalis	western spruce budworm	2
Dioryctria abietivorella	fir coneworm	1
Dioryctria pseudotsugella	a coneworm	1
Dioryctria reniculelloides	spruce coneworm	2
Eupithecia spermaphaga	fir cone looper	3
Henricus fuscodorsana	cone cochylid (a cone moth)	2
Holocera augusti	a cone miner	5
Holocera immacuiella	a cone miner	4
*Laspeyresia** *bracteatana*	fir seed moth	3

*Cydia

Engelmann Spruce		
Cones and seeds		
Chalcid		
Megastigmus piceae	spruce seed chalcid	2
Maggots		
Earomyia barbara	a cone maggot	4
Hylemya anthracina	spruce cone maggot	1
Midges		
Asynapta hopkinsi	cone resin midge	4
Dasineura canadensis	spruce cone gall midge	4
Dasineura rachiphaga	spruce cone axis midge	4
Moths		
Choristoneura occidentalis	western spruce budworm	2
Dioryctria abietivorella	fir coneworm	4
Dioryctria reniculelloides	spruce coneworm	2
Laspeyresia youngana	spruce seed moth	1
Grand Fir		
Cones and seeds		
Aphid		
Adelges piceae	balsam wooly aphid	1
Bug		
Leptoglossus occidentalis	western seed bug	3
Chalcids		
Megastigmus milleri	a seed chalcid	3
Megastigmus pinus	fir seed chalcid	1
Megastigmus rafni	a seed chalcid	3
Maggots		
Earomyia abietum	fir seed maggot	3
Earomyia longistylate	a cone maggot	4
Midges		
Asynapta hopkinsi	cone resin midge	4
Dasineura abiesemia	fir seed midge	4
Dasineura spp.	a cone midge	3
Resseliella sp.	a cone seed midge	3
Moths		
Barbara sp.	fir cone moth	1
Choristoneura occidentalis	western spruce budworm	1
Dioryctria abietivorella	fir coneworm	1
Epinotia hopkinsana	a cone moth	4
Eucosma siskiyouana	a cone moth	4
Incense Cedar		
Cones and seeds		
Bug		
Leptoglossus occidentalis	western seed bug	3
Moth		
Argyresthia libocedrella	incense cedar tip moth	1
Sawfly		
Augomonoctenus librocedrii	incense cedar cone sawfly	3
Scale		
Carulaspis juniperi	juniper scale	4

Jeffrey Pine		
Cones and seeds		
Beetles		
Conophthorus ponderosae	ponderosa pine cone beetle	2
Ernobius melanoventris	a cone borer	4
Ernobius montanus	a cone borer	5
Ernobius pinicola	a cone borer	4
Bug		
Leptoglossus occidentalis	western seed bug	3
Maggot		
Hapleginella conicola	a cone maggot	3
Midge		
Asynapta hopkinsi	a cone resin midge	4
Moths		
Eucosma ponderosa	western pine cone borer	3
Laspeyresia injectiva	jeffrey pine seed worm	3
Laspeyresia piperana	ponderosa pine seed worm	1
Rhyacionia buoliana	European pine shoot moth	4
Knobcone Pine		
Flowers		
Xyela serrata	a cone pollen sawfly	3
Cones and seeds		
Beetles		
Chrysophana conicola	flatheaded cone borer	4
Ernobius punctulatus	a cone borer	4
Paratimia conicola	roundheaded cone borer	4
Bug		
Leptoglossus occidentalis	western seed bug	3
Moth		
Dioryctria auranticella	ponderosa pine coneworm	3
Sawfly		
Xyela serrata	a cone and pollen sawfly	3
Lodgepole Pine		
Cones and seeds		
Beetles		
Conophthorus ponderosae (Conophthorus contortae)*	ponderosa pine cone beetle	2
Paratimia conicola	roundheaded cone borer	4
Bug		
Leptoglossus occidentalis	western seed bug	3
Midge		
Asynapta hopkinsi	cone resin midge	4
Moths		
Choristoneura lambertiana sub. subretiniana	a budworm	3
Dioryctria abietivorella	fir coneworm	1
Dioryctria cambiicola	a coneworm	3
Dioryctria reniculelloides	spruce coneworm	2
Eucosma rescissoriana	lodgepole cone moth	4
Holocera immaculella	a cone miner	4
Rhyacionia bouliana	European pine shoot moth	4

* Recently only one Pacific Northwest species of Conophthorus cone beetles has been recognized, this is Conophthorus ponderosae.

Lodgepole Pine		
Cones and Seeds (continued)		
Sawflies		
Xyela alberta	a cone sawfly	4
Xyelecia nearctia	a cone sawfly	4
Mountain Hemlock		
Cones and seeds		
Chalcid		
Megastigmus tsugae	hemlock seed chalcid	4
Maggots		
Hylemya anthracina	spruce cone maggot	3
Euromyia barbara	a cone maggot	4
Midge		
Asynapta hopkinsi	cone resin midge	4
Moth		
Eupithecia spermaphaga	fir cone looper	3
Noble Fir		
Cones and seeds		
Chalcid		
Megastigmus pinus	fir seed chalcid	1
Maggot		
Earomyia abietum	fir seed maggot	3
Midge		
Dasineura abiesemia	fir seed midge	4
Moths		
Barbara sp.	fir cone moth	1
Dioryctria abietivorella	fir coneworm	2
Pacific Silver Fir		
Cones and seeds		
Aphid		
Adelges piceae	balsam wooly aphid	1
Chalcids		
Megastigmus lasiocarpae	a seed chalcid	3
Megastigmus pinus	fir seed chalcid	1
Maggot		
Earomyia abietum	fir seed maggot	3
Moths		
Eupithecia spermaphaga	fir cone looper	3
Epinotia hopkinsae	a cone moth	3
Dioryctria reniculelloides	spruce coneworm	3
Ponderosa Pine		
Flowers		
Sawflies		
Xyela bakeri	a cone and pollen sawfly	3
Xyela cheloma	a cone and pollen sawfly	3
Xyela linsleyi	a cone and pollen sawfly	3
Xyela minor	a cone and pollen sawfly	3
Xyela obscura	a cone and pollen sawfly	3
Thrip		
Oxythrips coloradensis	a thrip	3

Ponderosa Pine (continued)		
Cones and seeds		
Aphid		
Cinara oregonensis	cone aphid	4
Beetles		
Conophthorus ponderosa (Conophthorus scopulorum)	ponderosa pine cone beetle	2
Dichelonyx backi	a scarab cone beetle	3
Ernobius melanoventris	a cone borer	5
Ernobius montanus	a cone borer	5
Ernobius pallitarsis	a cone borer	5
Ernobius pinicola	a cone borer	4
Ernobius punctulatus	a cone borer	5
Bug		
Leptoglossus occidentalis	western seed bug	2
Chalcid		
Megastigmus albifrons	ponderosa pine seed chalcid	2
Maggots		
Earomyia barbara	a cone maggot	4
Hapleginella conicola	a cone maggot	3
Midges		
Asynapta hopkinsi	cone resin midge	4
Resseliella sp.	a cone midge	4
Moths		
Chionodes periculella	cone miner	4
Choristoneura lambertiana sub. subretiniana	a budworm	4
Dioryctria abietivorella	fir coneworm	1
Dioryctria auranticella	ponderosa pine coneworm	3
Dioryctria cambiicola	a coneworm	3
Dioryctria rossi	a coneworm	3
Eucosma ponderosa	western pine cone borer	3
Eupithecia spermaphaga	fir cone looper	3
Laspeyresia miscitata	a seed worm	3
Laspeyresia piperana	ponderosa pine seed worm	1
Petrova metallica	metallic pitch nodule moth	3
Rhyacionia buoliana	European pine shoot moth	4
Sawflies		
Xyela bakeri	a cone and pollen sawfly	3
Xyela cheloma	a cone and pollen sawfly	3
Xyela linsleyi	a cone and pollen sawfly	3
Xyela minor	a cone and pollen sawfly	3
Xyela obscura	a cone and pollen sawfly	3
Port Orford Cedar		
Cones and seeds		
Midge		
Janetiella siskiyou	a seed midge	3
Moth		
Argyresthia libocedrella	incense cedar tip moth	1

Redwood		
Cones and seeds		
Beetle		
Phymatodes nitidus	a cone borer	4
Moth		
Henricus fuscodorsana	cone cochylid (a cone moth)	2
Shasta Red Fir		
Cones and seeds		
Chalcids		
Megastigmus milleri	a seed chalcid	3
Megastigmus pinus	fir seed chalcid	1
Megastigmus rafni	a seed chalcid	3
Maggots		
Earomyia spp.	a cone maggot	3
Hapleginella conicola	a cone maggot	3
Moths		
Dioryctria abietivorella	fir coneworm	2
Epinotia hopkinsana	a cone moth	3
Sitka Spruce		
Cones and seeds		
Aphid		
Adelges cooleyi	cooley spruce gall aphid	4
Chalcid		
Megastigmus piceae	spruce seed chalcid	2
Maggot		
Hylemya anthracina	spruce cone maggot	1
Midges		
Dasineura canadensis	spruce cone gall midge	4
Dasineura rachiphaga	spruce cone axis midge	4
Moths		
Heuricus fuscodorsana	cone cochylid (a cone moth)	2
Epinotia hopkinsana	a cone moth	3
Laspeyresia bracteatana	fir seed moth	3
Laspeyresia youngana	spurce seed moth	1
Dioryctria abietivorella	fir coneworm	3
Dioryctria reniculelloides	spruce coneworm	2
Subalpine Fir		
Cones and seeds		
Aphid		
Adelges piceae	balsam woolly aphid	1
Chalcids		
Megastigmus lasiocarpae	a seed chalcid	3
Megastigmus pinus	fir seed chalcid	1
Maggot		
Euromyia aquilonia		4
Midge		
Asynapta hopkinsi	cone resin midge	4
Moths		
Choristoneura occidentalis	western spruce budworm	1
Epinotia hopkinsana	a cone moth	3
Dioryctria abietivorella	fir coneworm	1
Dioryctria reniculelloides	spruce coneworm	2

Subalpine Larch		
Cones and seeds		
Maggot		
Hylemya laricicola	cone maggot	3
Sugar Pine		
Cones and seeds		
Beetles		
(Conophthorus lambertiana)		
Conophthorus ponderosae	ponderosa pine cone beetle	1
Ernobius pallitarsis	cone borer	5
Maggot		
Hapleginella conicola	a cone maggot	3
Midge		
Asynapta hopkinsi	cone resin midge	4
Moths		
Choristoneura lambertiana sub. lambertiana	sugar pine totrix (a budworm)	3
Eupithecia spermophaga	a cone looper	4
Western Hemlock		
Cones and seeds		
Chalcid		
Megastigmus tsugae	hemlock seed chalcid	4
Moth		
Dioryctria reniculelloides	spruce coneworm	2
Western Larch		
Cones and seeds		
Maggots		
Earomyia aquilonia	a cone maggot	2
Hylemya laricicola	a cone maggot	2
Moths		
Choristoneura occidentalis	western spruce budworm	3
Dioryctria abietivorella	fir coneworm	4
Henricus fuscodorsana	cone cochylid (a cone moth)	2
Western Redcedar		
Cones and seeds		
Midge		
Mayetiola thujae (Phytophaga thujae)	western redcedar cone midge	1
Western White Pine		
Cones and seeds		
Beetle		
Conophthorus ponderosae (Conophthorus lambertiana)* (Conophthorus monticola)*	ponderosa pine cone beetle	2
Bug		
Leptoglossus occidentalis	western seed bug	1

* Recently only one Pacific Northwest species of Conophthorus cone beetle has been recognized, this is Conophthorus ponderosae.

Western White Pine (continued)		
Cones and seeds		
Moths		
Dioryctria abietivorella	fir coneworm	1
Eucosma rescissioriana	a cone borer	3
Eupithecia spermaphaga	fir cone looper	3
White Fir		
Cones and seeds		
Chalcids		
Megastigmus pinus	fir seed chalcid	1
Megastigmus rafni	a seed chalcid	3
Maggots		
Earomyia abietum	fir seed maggot	3
Earomyia barbara	a cone maggot	4
Earomyia brevistylata	a cone maggot	4
Earomyia longistylata	a cone maggot	4
Hapleginella conicola	a cone maggot	3
Hylemya abietis	fir cone maggot	1
Midges		
Asynapta hopkinsi	cone resin midge	4
Dasineura abiesemia	fir seed midge	4
Moths		
Barbara sp.	fir cone moth	1
Choristoneura occidentalis	western spruce budworm	1
Dioryctria abietivorella	fir coneworm	1
Epinotia hopkinsana	a cone moth	3
Eucosma siskiyouana	fir cone borer	3
Eupithecia spermaphaga	fir cone looper	3
Laspeyresia bracteatana	fir seed moth	3

Table 2. Insects That Damage Flowers

Species	Lice	Sawflies	Thrips
Abies			
Grand fir	-	-	-
Noble fir	-	-	-
Pacific silver fir	-	-	-
Shasta red fir	-	-	-
Subalpine fir	-	-	-
White fir	-	-	-
Alnus			
Red alder	3*	3	-
Calocedus			
Incense cedar	-	-	-
Chamaecyparis			
Alaska yellow cedar	-	-	-
Port Orford cedar	-	-	-
Larix			
Subalpine larch	-	-	-
Western larch	-	-	-
Picea			
Brewers spruce	-	-	-
Engelmann spruce	-	-	-
Sitka spruce	-	-	-
Pinus			
Jeffrey pine	-	-	-
Knobcone pine	-	3	-
Lodgepole pine	-	-	-
Ponderosa pine	-	3	3
Sugar pine	-	-	-
Western white pine	-	-	-
Pseudotsuga			
Douglas-fir	-	-	3
Sequoia			
Redwood	-	-	-
Thuja			
Western redcedar	-	-	-
Tsuga			
Mountain hemlock	-	-	-
Western hemlock	-	-	-

* The numbers indicate that a damaging insect is present in this category and the importance of damage per damage codes listed on page 4.

Table 3. Insects That Damage Seed and Cones

Species	Aphids			Beetles				
	Cone	Gall	Wooly	Cone	Cone Borer	Cone Weevil	Seed	Twig Borer
Abies								
Grand fir	-	-	1	-	-	-	-	-
Noble fir	-	-	-	-	-	-	-	-
Pacific silver fir	-	-	1	-	-	-	-	-
Shasta red fir	-	-	-	-	-	-	-	-
Subalpine fir	-	-	1	-	-	-	-	-
White fir	-	-	-	-	-	-	-	-
Alus								
Red alder	-	-	-	-	-	-	-	-
Calocedus								
Incense cedar	-	-	-	-	-	-	-	-
Chamaecyparis								
Alaska yellow cedar	-	-	-	-	-	-	-	-
Port Orford cedar	-	-	-	-	-	-	-	-
Larix								
Subalpine larch	-	-	-	-	-	-	-	-
Western larch	-	-	-	-	-	-	-	-
Picea								
Brewers spruce	-	-	-	-	-	-	-	-
Engelmann spruce	-	-	-	-	-	-	-	-
Sitka spruce	-	4	-	-	-	-	-	-
Pinus								
Jeffrey pine	-	-	-	2	4	-	-	-
Knobcone pine	-	-	-	-	4	-	-	-
Lodgepole pine	-	-	-	2	4	-	-	-
Ponderosa pine	4	-	-	2,3	4,5	-	-	-
Sugar pine	-	-	-	1	5	-	-	-
Western white pine	-	-	-	2	-	-	-	-
Pseudotsuga								
Douglas-fir	-	4	-	-	5	4	3	4
Sequoia								
Redwood	-	-	-	-	4	-	-	-
Thuja								
Western redcedar	-	-	-	-	-	-	-	-
Tsuga								
Mountain hemlock	-	-	-	-	-	-	-	-
Western hemlock	-	-	-	-	-	-	-	-

Species	Bug	Chalcid	Maggots	
	Seed	Seed	Cone	Seed
Abies				
Grand fir	3	1,3	4	3
Noble fir	-	1	-	3
Pacific silver fir	-	1,3	-	3
Shasta red fir	-	1,3	3	-
Subalpine fir	-	1,3	4	-
White fir	-	1,3	1,3,4	3
Alus				
Red alder	-	-	-	-
Calocedus				
Incense cedar	3	-	-	-
Chamaecyparis				
Alaska yellow cedar	-	-	-	-
Port Orford cedar	-	-	-	-
Larix				
Subalpine larch	-	-	3	-
Western larch	-	-	2	-
Picea				
Brewers spruce	-	-	1	-
Engelmann spruce	-	2	1,4	-
Sitka spruce	-	2	1	-
Pinus				
Jeffrey pine	3	-	3	-
Knobcone pine	3	-	-	-
Lodgepole pine	3	-	-	-
Ponderosa pine	2	2	3,4	-
Sugar pine	-	-	-	-
Western white pine	1	-	-	-
Pseudotsuga				
Douglas-fir	1	1	4	-
Sequoia				
Redwood	-	-	-	-
Thuja				
Western redcedar	-	-	-	-
Tsuga				
Mountain hemlock	-	4	3,4	-
Western hemlock	-	4	-	-

Species	Midges					
	Cone	Cone Axis	Cone Gall	Cone Resin	Cone Scale	Seed
Abies						
Grand fir	3	-	-	4	-	3,4
Noble fir	-	-	-	-	-	4
Pacific silver fir	-	-	-	-	-	-
Shasta red fir	-	-	-	-	-	-
Subalpine fir	-	-	-	4	-	-
White fir	-	-	-	4	-	4
Alus						
Red alder	-	-	-	-	-	-
Calocedus						
Incense cedar	-	-	-	-	-	-
Chamaecyparis						
Alaska yellow cedar	-	-	-	-	-	-
Port Orford cedar	-	-	-	-	-	3
Larix						
Subalpine larch	-	-	-	-	-	-
Western larch	-	-	-	-	-	-
Picea						
Brewers spruce	-	-	-	-	-	-
Engelmann spruce	-	4	4	4	-	-
Sitka spruce	-	4	4	-	-	-
Pinus						
Jeffrey pine	-	-	-	4	-	-
Knobcone pine	-	-	-	-	-	-
Lodgepole pine	-	-	-	4	-	-
Ponderosa pine	4	-	-	4	-	-
Sugar pine	-	-	-	4	-	-
Western white pine	-	-	-	-	-	-
Pseudotsuga						
Douglas-fir	-	-	1	-	3	-
Sequoia						
Redwood	-	-	-	-	-	-
Thuja						
Western redcedar	1	-	-	-	-	-
Tsuga						
Mountain hemlock	-	-	-	4	-	-
Western hemlock	-	-	-	-	-	-

Species	Moths						
	Bud-worm	Cone Borer	Cone Looper	Cone Miner	Cone Moth	Cone-worm	Pitch Nodule
Abies							
Grand fir	1	-	-	-	1,4	1	-
Noble fir	-	-	-	-	1	2	-
Pacific silver fir	-	-	3	-	3	3	-
Shasta red fir	-	-	-	-	3	2	-
Subalpine fir	1	-	-	-	3	1,2	-
White fir	1	3	3	-	1,3	1	-
Alus							
Red alder	-	-	-	-	-	-	-
Calocedus							
Incense cedar	-	-	-	-	-	-	-
Chamaecyparis							
Alaska yellow cedar	-	-	-	-	-	-	-
Port Orford cedar	-	-	-	-	-	-	-
Larix							
Subalpine larch	-	-	-	-	-	-	-
Western larch	3	-	-	-	2	4	-
Picea							
Brewers spruce	-	-	-	-	-	-	-
Engelmann spruce	2	-	-	-	-	2,4	-
Sitka spruce	-	-	-	-	2,3	2,3	-
Pinus							
Jeffrey pine	-	3	-	-	-	-	-
Knobcone pine	-	-	-	-	-	3	-
Lodgepole pine	3	-	-	4	4	1,2,3	-
Ponderosa pine	4	3	3	4	-	1,3	3
Sugar pine	3	-	4	-	-	-	-
Western white pine	-	3	3	-	-	1	-
Pseudotsuga							
Douglas-fir	2	-	3	4,5	1,2	1,2	-
Sequoia							
Redwood	-	-	-	-	2	-	-
Thuja							
Western redcedar	-	-	-	-	-	-	-
Tsuga							
Mountain hemlock	-	-	3	-	-	-	-
Western hemlock	-	-	-	-	-	2	-

Species	Moths					Sawflies	Scales
	Seed Moth	Seed Worm	Shoot Moth	Tip Moth	Twig Moth	Cone	Cone
Abies							
Grand fir	-	-	-	-	-	-	-
Noble fir	-	-	-	-	-	-	-
Pacific silver fir	-	-	-	-	-	-	-
Shasta red fir	-	-	-	-	-	-	-
Subalpine fir	-	-	-	-	-	-	-
White fir	3	-	-	-	-	-	-
Alus							
Red alder	-	-	-	-	-	-	-
Calocedus							
Incense cedar	-	-	-	1	-	3	4
Chamaecyparis							
Alaska yellow cedar	-	-	-	-	-	-	-
Port Orford cedar	-	-	-	1	-	-	-
Larix							
Subalpine larch	-	-	-	-	-	-	-
Western larch	-	-	-	-	-	-	-
Picea							
Brewers spruce	-	-	-	-	-	-	-
Engelmann spruce	1	-	-	-	-	-	-
Sitka spruce	1,3	-	-	-	-	-	-
Pinus							
Jeffrey pine	-	1,3	4	-	-	-	-
Knobcone pine	-	-	-	-	-	3	-
Lodgepole pine	-	-	4	-	-	4	-
Ponderosa pine	-	1,3	4	-	-	3	-
Sugar pine	-	-	-	-	-	-	-
Western white pine	-	-	-	-	-	-	-
Pseudotsuga							
Douglas-fir	3	-	-	-	3	-	-
Sequoia							
Redwood	-	-	-	-	-	-	-
Thuja							
Western redcedar	-	-	-	-	-	-	-
Tsuga							
Mountain hemlock	-	-	-	-	-	-	-
Western hemlock	-	-	-	-	-	-	-